

## INFLUENZA AND EPILEPSY: FURTHER STUDIES UPON THE RELATIONS OF MENTAL DISEASE AND INFLUENZA.

BY KARL A. MENNINGER, M.D.,

TOPEKA, KANSAS.

WHAT effect has influenza upon idiopathic epilepsy?

Hippocrates is cited as saying that "acute fevers can influence epilepsy both favorably and unfavorably."<sup>3</sup> Of course, Hippocrates did not know of influenza, or at least not by its present name or reputation. When one recalls that acute infections have sometimes seemed to improve or even cure epilepsy, as well as some psychoses<sup>23</sup> and even hypophrenia,<sup>35</sup> it is the more pertinent to inquire if, after all, the influenza epidemic may have accomplished at least this morsel of good or if, on the other hand, it was as we supposed, "An ill wind that blows . . . etc."

Yet, strangely enough, the matter has never aroused much interest. Literature on the topic is remarkably scant. There were a few scattered communications on the general subject of epilepsy associated with the influenza epidemic of thirty years ago, and to date one<sup>10</sup> discussion of the subject in relation to the 1918 epidemic and one case report; the interim is barren.

Study of the question is facilitated by the large amount of material afforded by the epidemics of influenza of 1918 and 1920. Intramural ravages of the epidemic were experienced in most of the institutions for the care of epileptics in this country. Questionnaires addressed by the writer to the superintendents of these institutions were very courteously treated and the responses were gratifying. However, the severe crippling of the medical staffs as well as of the employee force as a result of war, influenza and price inflation made impossible the detailed notes and observations which would have been desirable. Pertinent data and cases from these replies are cited. In addition to these data I have certain cases for report taken from our Boston series<sup>2</sup> (the Psychopathic Hospital), from which we have presented previous studies of the relations of influenza and mental disease. I have emphasized<sup>35</sup> that it is not because influenza is so important *per se* that its relations to mental pathology have been thus the object of our persistent analysis, but because influenza furnishes us with a ubiquitous and tangible somatic factor.

The exact status of the somatopsychoses is perhaps as tenuous as that of any of the major groups of mental disease, and it behooves us to regard, with an extraordinary interest, any data available to further our knowledge concerning the interrelations of mind and body; or, better, of brain pathology and body pathology. What little has been achieved in this direction in the past has been done

by similar studies of typhoid fever, malaria, etc., diseases which could never compare in ubiquity with influenza, and which, thanks to the efforts of preventive medicine, are so rapidly decreasing as to be no longer sources of psychiatric study.\*

Delasiauve<sup>4</sup> as early as 1854 considered the subject of epilepsy and acute infections. He discusses the influence of various infections, *omitting influenza*, and decides for a specific effect for some (*e. g.*, erysipelas, he thought, improved epilepsy, whereas typhoid augmented the manifestations). He cites many writers and many cases of his own, and concludes in general, on this point, that "all severe and acute illnesses suspend or weaken epileptic fits and chronic ailments diminish them." Veyssset<sup>5</sup> undertook a detailed historic review and cites 6 cases, but nowhere refers even indirectly to influenza. Seglas<sup>6</sup> wrote at length concerning the influence of almost every sort of thing upon epilepsy—measles, scarlatina, fractures, erysipelas, malaria, etc.—but he nowhere makes mention of influenza. Certain of his conclusions are worth quoting here, however, even with this pertinent omission: "Intercurrent maladies have in the majority of cases a favorable influence upon the course of epilepsy. . . . This influence may not be manifested during the course of the intercurrent disease. . . . The acute diseases with febrile reactions bring about the most perceptible modifications."

Perhaps the most spectacular account of the effect of febrile affections upon epilepsy is that of Turnowsky,<sup>7</sup> of Marosvasarhely, who cites 3 cases of established epilepsy in which seizures were never again seen (six to fourteen years' observation) after attacks of pneumonia (two) and scarlatina (one). He is enthusiastic enough about these observations to suggest the possible therapeutic advantage in epilepsy of exposure to scarlatina or pneumonic infection.†

Upon recourse to the text-books one is again disappointed. Oppenheim<sup>8</sup> remarks that "acute febrile diseases often serve to inhibit the convulsions (of epilepsy), and recovery may even in a few cases be due to this cause." But his only mention of influenza in this regard is to cite (upon another page, 1215) an instance of reprecipitation of attacks, to be referred to later. Most of the writers are content to make some such ambiguous statement as

\* Recently Paulian<sup>9</sup> has made a detailed study of typhus fever; Skoog<sup>10</sup> recently reported briefly on measles. There has been rather more tendency of late toward psychiatric analyses of the endocrinopathies such as Raeder's<sup>11</sup> recent report on the endocrinopathic aspects of feeble-mindedness. All of these efforts are valuable because they give us additional data in the consideration of the broader question of somatopsychoses as a group.

† Whatever opinion one may form of this proposal, Turnowsky's suggestion of the possible application of the analogy of the phenomena of reinforcement and interference of the waves of light and of sound to the intercurrent of pathological entities is worthy of attention. The great principle of analogy is rather likely to be applied, we think, too closely within the separate (?) spheres of scientific study, and this wide flight of Turnowsky's, for all its novelty, certainly has merits of originality and perhaps of faithfulness.

this, from Paton:<sup>9</sup> "The relation of the acute infectious diseases to this psychosis (epilepsy) has been repeatedly emphasized by clinicians—measles, diphtheria, typhoid, as well as whooping-cough, scarlet fever and malaria."

### I. EVIDENCE THAT INFLUENZA MAY IMPROVE EPILEPSY.

That there is often observed a cessation of attacks during the height of the acute illness has been commented upon by various writers, some of whom have been quoted. Maillard and Brune,<sup>10</sup> in addition to pointing out the increased susceptibility of epileptics to influenza, put emphasis upon the "almost complete suppression of attacks during the period of acute (influenzal) illness" in all their cases. They found that the average total number of attacks was lowered from 105 daily prior to the epidemic to 14 attacks daily during the febrile period. "The curve of attacks in the course of the influenzal infection is absolutely characteristic in all of our observations, an arrest of the epileptic by the influenzal process."

Similar observations were made in this country. Dr. H. B. Carriell, managing officer of the Dixon (Illinois) State Hospital, replied to the question of the effect of influenza upon the epileptics in his institution as follows:

"It was not found that the disease had any permanent effect upon the epileptics. It was noticed, however, that of those suffering from influenza almost none had seizures (of epilepsy) during the attack (of influenza). This was especially true during the time that their temperatures were abnormally high or subnormal."

This fact is also pointed out in a letter from Dr. David Fairchild Weeks, superintendent of "The Village for Epileptics," at Skillman, New Jersey. "During the time the patients had a rise in temperature they did not have convulsions."

The following case is one studied at the neurological clinic of the Boston Dispensary (then in charge of Dr. Abraham Myerson), where the writer was an assistant visiting neurologist. The case is reprinted in abstract from a previous communication dealing with mental diseases associated with influenza.<sup>11</sup>

**CASE I.—Family History.** A white school boy, aged fourteen years, had a father who was subject to outbursts of temper, and a mother who was subject to chronic headaches. One sister is living and well.

**Past History.** Unimportant.

**Epileptic History.** In August, 1916, he had a sudden epileptiform seizure, quite typical in form. They recurred frequently thereafter, averaging one a month.

**Present Illness.** In September he contracted severe influenza. During his illness he had three, possibly four, more seizures. The

last was on October 21, while he was still bedridden. Thereafter he was seen in the nerve clinic frequently and had no more seizures. (Seen January 14). A physical examination was entirely negative and a Wassermann test on the blood serum was negative.

**INSTITUTIONAL DATA.** Dr. William T. Shanahan, of the Craig Colony for Epileptics, at Sonyea, New York, in a most comprehensive summary, writes:

"Six patients (one male, five females) had *fewer* seizures during the period of influenza and a period of *three weeks before* and *three weeks after* the attack than their usual wont. (This is contrasted with twenty-five patients who had more.)

"Seven patients (all females) had *fewer* attacks per month for the *next nine months after* the influenza than for the preceding months (contrasted with sixteen patients who had more attacks.)"

Dr. Shanahan kindly furnishes the following representative abstracts, as illustrative:

**CASE 2.**—Agnes S., aged seventeen years, an epileptic for eight years. Monthly average seizures for nine months before influenza, sixteen. During October and November, when she had a moderately severe influenza, ninety-three seizures. Monthly average during nine months following this period, eight.

**CASE 3.**—J. S., female, aged ten years, epileptic since seven months of age. Monthly average for nine months before influenza, ten seizures. During October and November, when influenza occurred, twelve seizures. Two of these occurred while in bed with influenza. Monthly average of seizures for nine months following influenza, five.

**CASE 4.**—W. S., female, aged twenty-eight years. Epileptic for twenty-four years. Monthly average for nine months before influenza, six seizures. During October and November, eight seizures, three occurring while ill with influenza. Monthly average for nine months following influenza, four seizures.

For the following 2 cases I am indebted to Dr. O. S. Hubbard, superintendent of the Kansas State Hospital for Epileptics at Parsons, Kansas:

**CASE 5.**—"Miss H., an epileptic imbecile, has been in the hospital fifteen years. She comes from a defective family. Her seizures usually occur in series at long intervals. She is of the noisy talkative kind, who irritate those about them by persistent conversation. She was extremely sick with influenza, and while she had no distinct pneumonia, had respiratory difficulty. For a number of days her fever remained about 105°, and that gradually subsided. While her fever was high she was much more quiet and talked in a rather

intelligent manner—in fact, seemed another personality, almost normal. With the improvement in her health her mind returned to its former standard and she is in every way much as she was before being sick.”

CASE 6.—“Mr. W. had been a patient of the institution for a number of years. For a considerable period he was on parole, and under excessive sedation in the form of patent medicine he became much reduced in health. He contracted influenza which was complicated by pneumonia, from which he made a good recovery. He improved markedly both physically and mentally. One forenoon he had five grand mal seizures in quick succession and following them developed edema of the lungs, from which he died that evening.”

## II. EVIDENCE THAT INFLUENZA MAY AGGRAVATE EPILEPSY.

Aggravation of epilepsy may be conceived of as taking any of four forms:

1. Simple increase in severity and frequency of attacks.
2. Reprecipitation of long latent epileptic attacks.
3. Alteration in the form of the attacks.
4. Production of a complicating psychosis.

Illustrations of each of these are at hand.

1. INCREASED FREQUENCY AND SEVERITY OF ATTACKS AFTER INFLUENZA. The suppression of attacks of epilepsy during the acute period of illness (influenza) as discussed above is not stated by any of the writers or any of my communicants to have been permanent. So much for negative testimony. On the other hand, Dr. Shanahan writes:

“One patient had status epilepticus during the height of the influenza.

“Twenty-five patients (5 males, 20 females) had more seizures *during the period of the influenza* and a period of three weeks before and three weeks after the disease” (than their average wont). (This is contrasted with 6 patients who had fewer seizures at Sonyea.)

During the *nine months* which have passed since the epidemic 11 males and 5 females who had the disease have shown an increase in the frequency of seizures. (These 16 patients contrast with only 7 who showed a decrease in frequency of attacks.)

Dr. Shanahan also furnishes the following abstracts of cases illustrating the above stated increase in frequency:

CASE 7.—E. Z., female, aged twenty years, an epileptic for ten years. Monthly average for nine months before influenza, twelve seizures. During October and November, eleven seizures. No

seizures while in bed with influenza. Monthly average for nine months following influenza, sixteen seizures.

CASE 8.—E. V., female, aged twenty-two years, epileptic since early infancy. Monthly average for nine months before influenza, twenty-six seizures. During October and November, fifty-two seizures, nine of which occurred while ill with influenza. Monthly average for nine months following influenza, thirty seizures.

CASE 9.—Jacob F., aged twenty-two years, epileptic eighteen years. Average from four to ten seizures monthly for nine months preceding influenza. During influenza period seizures continued with same frequency. During nine months following influenza, seizures were more frequent, averaging thirteen to sixteen per month.

CASE 10.—Albert P., aged fifty-five years, epileptic for forty-two years. For nine months preceding influenza had but four seizures. During influenza period had eleven seizures. During nine months subsequent to influenza averaged two or three seizures each month.

CASE 11.—John R., aged thirty-four years, age of onset unknown. Patient at the colony for twenty years. For nine months preceding influenza, period averaged five to six seizures monthly. During influenza period had fifteen seizures. During nine months following influenza period has had from seven to ten seizures on average per month.

CASE 12.—Charles G., aged thirty-six years, epileptic twenty-one years. For nine months preceding influenza period had average of one seizure per month. During influenza period had twenty-one seizures. Since influenza period had averaged from six to eight seizures per month.

CASE 13.—Fred P., aged thirty-eight years, epileptic since ten years. For nine months preceding influenza averaged ten per month. During influenza period had fifty seizures. During nine months following influenza period has had an average of thirteen seizures per month.

2. REPRECIPITATION OF LONG LATENT EPILEPTIC SEIZURES. Another phenomenon of aggravation is the precipitation of a recurrence of attacks in a patient previously frankly epileptic but in whom supposed recovery or long remission had occurred. This is not infrequently casually referred to in the literature, but I do not know that it is anywhere critically discussed. Oppenheim<sup>8</sup> cites the case of "G, a neuropsychopath," who had suffered from "conditions of anxiety and imperative ideas." "Three times during his

life he had an attack of an epileptic character, once in his seventeenth year after great exertion, one in his twenty-third year after sleepless nights *and one at the age of thirty years after influenza*. In this last attack he was carried home in a state of absolute unconsciousness."

An excellent illustration of this phenomenon is reported by Dr. William T. Shanahan in the communication above mentioned. Dr. Shanahan writes:

CASE 14.—"Althea D., aged twenty-three years, who developed epilepsy in infancy and had fairly frequent seizures for some time. She was admitted to the Craig Colony, July 30, 1908, and discharged January 5, 1909, as improved; readmitted December 21, 1911, and discharged January 8, 1915, as recovered, having had no seizures in over two years. In a communication had on July 22, 1919, from this former patient, she stated that subsequent to her discharge from the Colony she had no seizures until after a severe influenzal infection in November, 1918. Since this time she has had frequent attacks, as many as twenty in forty-eight hours in one instance."

Another very similar case of the reprecipitation of epilepsy by influenza occurred in our Boston series and will be presented here. These cases represent latent processes stimulated to renewed activity by the influenza neurotoxins.

CASE 15.—M. W., female, aged thirty-six years, Red Cross canteen worker.

*Family History.* Negative, except that she was three-eighths Hawaiian, and that a sister had epileptic seizures throughout her life and died at thirty-two after seven weeks of convulsions.

*Past History.* The patient was an intelligent and cultured woman whose past history was (aside from her epilepsy) simply that of an active and able school teacher. She had held some responsible pedagogic positions, and had travelled extensively.

Medically there was no point of particular interest aside from the present illness and the past epileptic attacks. Her habits were above reproach. Relatives and family physician were interviewed and a long history secured.

*Epileptic History.* Her first seizure was at the age of sixteen, *following a severe attack of measles*. Nothing further is remembered of this by any informant or the patient. The second attack was twelve years after the first, at the age of twenty-eight, the third two years later and the following year, at the age of thirty-one, she had a fourth attack. The present illness ushered in the next attacks, five years after the one just mentioned.

*Present Illness.* The patient had not been overwell for some months, partly owing, it was thought, to her supreme overexertion in the cause of the canteen work. One doctor said that she had "subacute appendicitis."

For about a week before admission she was definitely ill. She had had a fever of at least 102° at one time, three or four days prior to her admission, but in spite of feeling wretched and deserving to be in bed, she struggled on with her canteen work. There seems to have been little doubt but that she had influenza.

January 7, at 8.30 A.M., she suddenly had a severe convulsion, repeated at 2 P.M. and 4 P.M., and possibly one other time. She was unconscious after the first seizure: "Knew nobody and could not be taken care of."

*Hospital Admission.* The patient lay in bed when first seen and to all interrogations responded only with a hoarse groan, often reiterated. She suddenly jumped out of bed, uttering groan after groan, and danced about the room. The nurse led her to the toilet, but she ignored it. She continued her jumping and groaning. She could scarcely be held in bed, and when the nurse left her she crawled on top of the bed, removed her night-gown and squatted nude on her hands and knees, where she remained. Soon after this episode the patient began to clear up and within a few days seemed quite normal, although she was not wholly so for nearly a week.

Mental examination, aside from the points noted, physical examination, neurologic examination and laboratory findings were all negative.

Diagnosis: Series epilepticus, precipitated by influenza.

3. ALTERATION IN THE FORM OF THE ATTACKS. The only case illustrative of this phenomenon is one previously cited in a more general article referred to above and reprinted in abstract here. Noteworthy is the unusual change from the typical convulsive seizures to the somnambulistic or twilight state episodes as well as the increase in frequency of attacks. These cases illustrating the phenomenon of altering type of epileptiform manifestations are infrequent in the literature. I cite (free translations) two cases of Van Deventer's.<sup>16</sup>

A twenty-three-year-old male who, from the earliest youth until three years previously, had suffered from attacks of confusion (Verworrenheit) in which he undressed himself, ran hither and thither, as if seeking something, was brought to the hospital after an epileptic attack in the street, associated with influenza and urticaria. The day before he had felt ill, and as we learned later had had one attack which he himself did not remember. A week later he felt completely well.

A male patient of thirty-six, with slight facial asymmetry, who suffered occasionally from vertigo-epileptica and for the past twelve weeks also from headache, had, one morning before going to work, a severe epileptic attack. He regained consciousness first six hours later and seemed to be suffering with influenza associated with *tic douloureux*. He knew absolutely nothing of having had an attack, or that he had just come out of one. On the following day he was all right.



My own case now follows.

CASE 16.—Male, aged twenty-two years, single, discharged sailor, born in U. S. A.

*Family History.* Negative except that one paternal uncle is said to have had epilepsy.

*Past History.* Normal childhood. He left the high school and joined the U. S. Navy.

*Medical History.* Unimportant.

*Epileptic History.* Began at the age of twelve. Thereafter they occurred about every two months until about a few years prior to admission. The attacks entailed the characteristic tonic convulsions, frothing, biting the tongue, etc., but were not extremely severe, and as they were preceded by a somewhat prolonged aura he had never injured himself severely. They were always followed by a period of headache and malaise, with total amnesia for the events of the seizure. For a year or so prior to his enlistment in the navy they had been decreasing in frequency, under the treatment of Dr. Waterman, of Boston.

*Present Illness.* September 30 he contracted influenza and was in the hospital until November 1. He had pneumonia and was not expected to live. He was delirious during his acute illness and did not remember his father's visits. He had no epileptic attacks during the month (sic).

During November and December he had three attacks. These were of the nature of somnambulism, however, instead of the convulsive type as previously. He was noticed by his employer one day to be mismanaging his duties clumsily and when addressed did not reply, so was taken home where he subsequently recovered without memory for the event. Again, he suddenly left work, taking with him a friend's letter, to which he was in no way entitled, and was observed to stagger as if drunk. The third attack was the event leading to his coming to this hospital. He last recalls being at his work as usual; the police found him wandering the streets in an adjacent suburb of Boston, and, failing in satisfactory replies, he was brought by them here. "In the admission office he has to be prodded with questions frequently in order that any answers may be elicited, and to keep him awake. He said he could not tell where he had been living in Boston the past three years. Later replies that he was a radio student at Harvard."

He was taken to the ward, fell immediately asleep and when seen the following morning was quite clear, but could give no account of the interval between leaving work the day before and awaking in this hospital.

Mental examination, physical examination, and laboratory findings entirely negative. Psychometric test gave rating of 17 plus.

Diagnosis: Epilepsy; twilight state.

4. PRODUCTION OF A COMPLICATING PSYCHOSIS. The phenomenon of epileptic psychosis is only one of the recesses of that great mystery epilepsy. Analogous to the psychoses associated with hypophrenia, the psychoses associated with epilepsy are all too little understood. In both hypophrenia<sup>35</sup> and epilepsy, influenza evokes psychoses. In the following instances in every case the epilepsy was of long standing, yet all the stress and strain, haps and mishaps of life had not served to induce a psychotic episode. It surely bespeaks again for influenza the unenviable quality of a most potent neurotoxin.

Dr. O. S. Hubbard, superintendent of the Kansas State Hospital for Epileptics, kindly furnished the following case abstract:

CASE 17.—Mr. J., a clergyman, aged forty-four years, graduate of Boston University, had no family taint, but was a nervous individual. When four years of age received a head injury, and now has a small depression of the right motor area. About eight years ago, while sick with mumps, had "spasms of the left arm," since which time he has had occasional seizures, mostly petit mal, which were controlled to some extent with bromide. Was admitted here April 3.

About three weeks before this had influenza complicated with pneumonia. He seemed to be recovering from this attack when he developed an acute mania, was very restless, sleepless and noisy. Developed delusions directed against his wife and children, etc. Was controlled by drugs before entering the hospital, a considerable amount of morphin being used.

Upon entering the hospital he was noisy, talkative and did not sleep much. It was feared that he would die from exhaustion, but by careful feeding and attention to his general condition he gradually improved, and ultimately made a good recovery from his mania, and left the hospital in his usual state of mind. A letter from him states that he is feeling well and able to attend to some business affairs, but is not trying to do church work. This man had two Wassermann tests, which were reported as 2 plus and 3 plus."

In the case just cited the question of possible neurosyphilis is suggested and left unanswered.

In the following case, taken from our Boston series, there is obviously a combination of hypophrenia, epilepsy, influenza, parturieny and psychosis. Who will say how these should be placed as to cause and effect?

CASE 18.—Female, aged twenty-three years, born in Sweden, sixteen years in this country; married; housework.

*Family History.* This was quite meager. It was believed that her mother was a queer woman, with an exophthalmos, but not definitely psychotic, and no epileptic members of the family, direct or indirect, were known to her husband.

*Past History.* The patient was always a rather eccentric girl, but with a lovable, happy, sociable disposition, which made her popular in spite of her oddities. Supposedly following a fall "in childhood" (nothing more specific), she began to have convulsive seizures at intervals, persisting until puberty. They then ceased entirely and she is believed to have had none for nearly ten years. However, for some four years or more prior to the present account she had had what may be interpreted as psychic equivalents. "She will clear up for a time and then be peculiar again. . . . She makes simple-minded remarks. . . ."

October 2 the patient developed influenza and three days later was delivered of a seven months' pregnancy. From October 12 to 21 her temperature fluctuated from 97° to 99.5°. About October 20 she began to show mental symptoms. The chief of staff of the hospital wrote: "She now shows fear, anxiety, contriteness for supposed sins, wakefulness and loud calling at night. . . Wants to climb out of the hospital window, and says she hears and views strangers and has been very bad. Excited, depressed, nervous, feeble-minded (?)."

With this shower of psychic symptoms she began again to have epileptiform convulsions, having two on October 23 and at least one on October 24, the day of admission to the Psychopathic Hospital.

*Mental Examination.* When the patient was admitted she had a temperature of 101°, pulse of 110, respirations of 40. Examination of lungs confirmed a diagnosis of bronchopneumonia. Thorough mental examination was not practicable, but it was determined that she was approximately oriented, not grossly amnesic, but self-accusatory and deluded in vague and intangible ways. She preserved a fair insight, saying that she had had "influenza and a touch of pneumonia," her mind "mixed up," she was "seeing visions" and her "fits" were coming back, as in childhood, when she "falls down and bites" her tongue. She reacted to visual and auditory hallucinations; she heard the Kaiser outside her room and saw him "with a tail and all black." She was apprehensive and quite amenable to suggestions, obedient and not disorderly. She ate and slept well, kept herself covered and in bed, and was at no time violent.

*Course.* Her pneumonia signs disappeared by the end of a week and she is believed to have had but one more convulsion. There was at no time any muscular fibrillation, alteration of reflexes, diplopia, exophthalmos, etc., or other evidences of encephalitis.

She was up and about the ward after eight days and made herself agreeable and helpful. A routine mental examination was essentially negative except for absence of insight and a conspicuous defect in memory and intellectual processes, suggestive of hypophrenia. At times she was observed to laugh in a rather silly fashion and at other times to cry a little "for home, husband and family."

Physical examination in all ways negative, except as mentioned. Laboratory findings showed negative urine, blood serum, spinal fluid but positive smear for gonococci.

Psychometric rating was 10.7 on the Yerkes-Bridges point scale, with a variation total of 12. "In the supplementary tests her performance of the construction puzzles was good. She did poorly in the memory tests, adding details not in the original. She coöperated well and was interested."

She was discharged on the twenty-fifth day. The psychotic episode accompanying the convulsion may be interpreted either as a typical delirium, or, as seems better to me, as a transient epileptic psychosis. The basis of hypophrenia seems evident. The seizures are not likely to be regarded as encephalitic in the face of the facts that they preceded the frank pneumonia and were not accompanied by the more typical signs of encephalitis, and there is the history of epilepsy in childhood. The influence of the parturition is more likely to be overestimated than underestimated.

The following history is also from our Boston series, and is more typical of a "pure" epileptic psychosis:

CASE 19.—A. T., female, aged twenty-two years, Russian born, German descent: H. W. Admitted November 29, 1918.

*Family History.* The mother had had epileptic attacks "once every few years." No further data was secured except that she had not been psychotic. Otherwise the family history was irrelevant. Three normal siblings.

*Past History.* The patient was born in Russia and came to the United States at eighteen. She had always been a healthy child. She had four years of a common school education, and it is reputed that it was difficult for her to learn. She did some work on the farm in Russia, but housework only since arriving in America. "She is a good worker, but does not remain very long in one place, and usually found the work too hard."

Her personality is described as being "always good-natured, sociable and very happy; well liked by people, energetic, fond of dancing and very little of a reader." She used no alcohol, had no court record, was a Lutheran Church member and normally interested therein.

*Present Illness.* Epilepsy: Began to have epileptiform attacks in January, 1918. They were quite infrequent at first, and in fact there is no positive evidence that she ever had any more than the one first attack until after her influenza.

*Influenza.* The last of October she contracted influenza and was in the B. Hospital for three weeks. She then returned to her employer's home, but was not permitted to work on account of her physical weakness. November 23 she had a series of epileptic attacks (these are the words of the informant, and unfortunately

no further data was secured, except a corroboration by the patient of the occurrence of some seizures). She was in bed two days following this and incapacitated by weakness for two more days. November 28 "she began to forget things," showed queer conduct, disorder, said "flies kept her awake at night and that people were mean to her, that everyone was about to die, that the sun had gone down and hence her mother had died, everyone said their prayers and appointed her employer as her lawyer and delivered to him all of her small effects."

*Hospital Admission.* She was very noisy when first admitted, singing at the top of her voice as she marched about the ward gesticulating. The ideas that "race through her mind" were expressed in her endless loud singing, and she was quite inaccessible.

*Mental Examination.* The patient was totally disoriented in all spheres at times, although at other times gave correctly her name and address and once the date nearly correctly. After the first day she grew more quiet, was for a time depressed and then again disturbed. No delusions or hallucinations were proved. The attention was very poor, associations loose and slow, train of thought frequently broken and revealing irrelevancies. Her memory was notably defective for both recent and remote events.

Later the patient became apparently normal, so remained for a few days, and then became disturbed again within the week. A note reads:

"She is grunting and groaning in a monotonous, noisy way, 'Oh, Oh'-ing and 'Oh, my God'-ing with tireless repetition, not even stopping long enough to define her pains or answer questions. 'Here, there, help me, God! In my legs! Oh, my God! Oh, Oh, my arms! Oh, my legs and arms! Oh, my God! Oh, Oh!'"

Physical examination wholly negative, including gynecologic. Neurologic examination, including ophthalmoscopic, wholly negative, except for pseudoclonuses on the right side. Laboratory examination of blood, blood serum, spinal fluid and urine were negative.

*Course.* After ten days' observation she was committed to the Westborough State Hospital. I quote from a letter from the Superintendent, Dr. H. O. Spalding, regarding her condition on June 14, six months after commitment:

"We diagnosed her as a case of epilepsy. Wassermann negative. Orientation impaired. Train of thought confused and retarded. At times shows some spontaneity; emotionally unstable, apprehensive and worried. Hallucinations not established. Insight partial. She has improved some and goes to the industrial room daily and gets along well with the nurses and patients."

The following case from the writer's private practice may be briefly referred to here:

CASE 20.—A male, aged sixty-one years, developed epileptiform manifestations at the age of fifty-four. He was carefully studied by several neurologists, and the diagnosis of idiopathic epilepsy was made by exclusion. He had been having petit mal every few months and grand mal about twice a year, the last attack occurring in December, 1918, during the influenza epidemic. He did not, however, have influenza. Pneumonia of very severe grade in November, 1919, was followed by a postfebrile psychosis which was quite typical in its manifestations, gradually clearing and disappearing within a month. One seizure supervened.

### III. EVIDENCE THAT INFLUENZA MAY CAUSE EPILEPSY.

Dr. L. Pierce Clark<sup>12</sup> recently presented in a brief report a case of influenza ushered in by epileptic attacks in a child of two years. The epileptiform seizures continued after the influenza, but were decreasing in frequency and severity. As Dr. Clark claims, this is the first similar case reported from the recent epidemic, but as I have pointed out,<sup>31</sup> in previous epidemics the phenomenon has been noted repeatedly. Leichtenstern in his justly celebrated monograph<sup>13</sup> writes:

" . . . Influenza frequently begins in children with an eclamptic seizure, and very rarely in adults with typical epileptiform attacks combined with total unconsciousness and succeed in stupor." He then goes on to consider "those cases in which directly following the influenza attack a typical but chronic epilepsy develops with seizures occurring in short or long intervals . . . (but) . . . so far as we know of these cases they all, after a longer or shorter time, end in recovery. We know of no recorded case in which permanent epilepsy followed influenza, although the occurrence is not thereby excluded. A case . . . of epilepsia gravis-sima may be mentioned here. . . ." He cites the case of a male of seventeen who began to have typical epileptiform seizures a few weeks after the termination of his influenza, which recurred with increasing frequency until ten to twenty-five attacks daily were experienced. Subsequently a distressing psychosis complicated, or at least dominated the picture, and he was committed, but eventually made a complete recovery.

Leichtenstern then goes on to discuss "many other forms of convulsions and disturbances in movement . . . observed during influenza or thereafter."

Gowers<sup>1</sup> cites 39 cases of epilepsy subsequent to scarlet fever, 12 to measles, 8 to typhoid and "a few" only to influenza. Voisin<sup>19</sup> mentions influenza as producing epilepsy, but does not discuss it. Gelineau,<sup>20</sup> in his treatise on epilepsy, discusses the matter at some length. He concludes that influenza is "capable of giving birth to epilepsy or exercising over it influence of augmentation of number

and severity of attacks." He cites one case of his own: "An English girl, aged eight years, in whom there was apparently recovery following a ligation of the vertebral arteries." He cites 3 cases of Biet's,<sup>21</sup> taken, he says, from Ulliel:

1. Jacksonian epilepsy in a physician of twenty-five with recovery.
2. A "young girl" with two epileptic grandparents who developed typical idiopathic epilepsy.
3. Jacksonian epilepsy in a male of forty-one.

He also refers to the cases of Kraepelin, Mariott and Bidon, and notes that some apparently were influenced favorably and some unfavorably.

Gelineau implies in his discussion that these epilepsies are probably manifestations of miliary cortical hemorrhages. This theory is the more plausible, it seems to the present writer, by virtue of the pathologic demonstrations of miliary hemorrhagic encephalitis in deaths from influenza or after influenza.

Other such cases of epileptiform attacks precipitated by influenza have been reported by Ruhemann,<sup>14</sup> Landgraf,<sup>15</sup> Van Deventer,<sup>16</sup> and Jaccoud.<sup>17 18</sup> Van Deventer<sup>16</sup> cites 3 cases, which might be put in this group. One was an alcoholic male, forty-one, in whom influenza began by an epileptic seizure, followed shortly by another. The second was a man of forty, who, shortly after recovery from influenza, had a severe seizure while standing on the sidewalk. A twenty-two-year-old girl of good heredity, but herself peculiar, and excitable, had a typical epileptic attack at the onset of influenza. In all of these previous epileptic symptoms were denied.

Through the kindness of Prof. Adolph Meyer, of Johns Hopkins Medical School, the writer was permitted to see the following case, at the Phipps Psychiatric Clinic, in Baltimore, an abstract of which was graciously furnished.

**CASE 21.**—G., a farmer, aged thirty-five years, was admitted to the Phipps Psychiatric Hospital on January 9, 1920.

*Family History.* Entirely negative.

*Personal History.* Born in West Virginia. Measles and whooping-cough in childhood, otherwise quite healthy. He attended school in the country from six to eighteen years, finishing the eighth grade. He helped work his father's farm after school hours, and from the age of twenty-five he managed the farm alone with success. He was always an even tempered person with little tendency to disagree or argue. Never felt blue or restless. He was inclined to stay to himself; rarely mingled with girls. He had felt under obligations to support his family and was following the custom of the family to avoid marriage until late in life. There is history of autoerotism from twelve to sixteen. Promiscuous sex relations until the present time, about once every few months.

*Present Illness.* In September, 1918, an attack of influenza kept the patient in bed for three weeks with headache, slight fever and extreme weakness, leaving him still weak and sluggish after convalescence. He undertook the usual duties about the farm in spite of his illness. In attacks coming about every other day he reeled as he walked and frequently had to support himself, and was weak and dizzy. He regained sufficient strength to finish jobs without serious handicap until the following summer, when he began to tire easily, and often was obliged to stop to rest. In August, 1919, there were periods of two or three minutes lapse of consciousness coming once or twice a week, when he suddenly stared into space or busied himself meaninglessly with queer undertakings; "muttered or walks about." At one time, while loading hay, he suddenly dropped the fork and wandered about the fields for three minutes without any recollection of the episode.

He has grown continuously weaker and nervous and more forgetful until he was obliged to stop work altogether in the fall of 1919 and January, 1920. He says: "I just lose my mind. It goes away so quick and comes back the same way. I do not know anything." Never falls or convulses. Brother says preceded by "swallowing."

*Somatic Status:* The patient presents no indication of systemic disorder other than hyperactive K. K. and A. J., fine tremor of the extended fingers and writing defect. Blood and urine negative. B. P., 124-76.

*Mental Status and Course in the Hospital:* Mental examination negative. While in the ward he has shown nothing in the way of abnormal behavior or attitude other than an occasional appearance of disinterest. Had seven attacks in January. Nine teeth extracted January 28. Three attacks subsequent week.\*

The result of the questionnaire addressed to the superintendents of the hospitals for epileptics indicate that such cases were rare in the recent epidemic. Replies from Dr. O. S. Hubbard, superintendent of the Kansas State Hospital for Epileptics; Dr. H. B. Carriel, superintendent of Dixon (Illinois) State Hospital; Dr. A. S. Priddy, superintendent of the Virginia State Epileptic Colony of Madison Heights; Dr. David F. Weeks, superintendent of the Village for Epileptics at Skillman, New Jersey; Dr. L. V. Guthrie, superintendent of the Huntington State Hospital of West Virginia, and Dr. T. B. Bass, superintendent of the State Epileptic Colony of Abilene, Texas, make a unanimous reply in the negative

\* In the hospital he had two attacks of lapses of consciousness. On January 14, 1919, he sprang from his bed; brushed the nurse aside and stalked down the corridor to return immediately in full consciousness without recollection of doing anything out of the way. On the 15th he sat quietly in a chair and mumbled in an undertone several times "get 'em out of here" and made brushing movements with the hands. He then took the bed clothes off the chair, turned the mattress down on another bed and was about to crawl into it when he came to himself. He has never had convulsions, tongue biting, incontinence, or falling spells.



to the question as to the number of cases admitted in which epilepsy was given or considered as a precipitating factor.

One further case is, however, reported by Dr. W. T. Shanahan, of Craig Colony.

CASE 22:—J. O'D., male, aged nineteen years.

*Family History.* Mother died at forty-four years of influenza. Father living and well, aged forty-two years, a barber, for twenty-five years markedly alcoholic.

Patient is the sixth in line of birth of ten living children. Three girls died in infancy. No history of nervous or mental disorders in family.

*Past History.* Patient born October 17, 1900; apparently normal birth, nursed by mother. History of convulsions during dentition. No difficulty in learning to walk or talk. Alleged to have had infantile paralysis at two years, followed by hemiplegia. Began school at six years, graduated from public school at fifteen years and attended night school for one year. Had measles at three years, diphtheria at twelve years.

*Present Illness.* Had severe attack of influenza during the fall of 1918. Following this he had a severe convulsion. His convulsions recurred daily for a short time, when he was free for three or four weeks. After admission to the colony he had a typical grand mal seizure, apparently no aura. Seizures occur both during sleep and waking periods.

At time of admission to the colony he was dirty, and apparently had given no attention to personal cleanliness. Features small, with eyes set close together. Ears small and close to head. Nose narrow and pointed. Many carious teeth, some missing. Palate narrow and high arched. Heart, lungs and abdomen negative. Marked right lateral curvature of spine, compensatory for shortening of the right leg. Flaccid paralysis of right lower extremity with extreme atrophy of muscle. Right thigh circumference, 11 inches; left thigh, 17½ inches; right calf, 7½ inches; left calf, 13 inches; right ankle, 6 inches; left ankle, 8 inches. All reflexes normal except right lower extremity. No Babinski.

Mental Examination: Scored fifty-four points with Yerkes-Bridges point scale. Would not cooperate in various tests.

What attitude shall we take toward these cases of apparent epilepsy which were precipitated by influenza? Shall we turn to Gelineau's attractive theory of miliary cortical hemorrhages as the result of influenza and the cause of epilepsy? All of us have seen cases of cerebral concussion followed by epileptiform attacks\* and

\* Dr. W. F. Bowen, Topeka, gave me the details of the following case: A boy of sixteen was struck in the head with a batted baseball. He walked to the bleachers and sat down holding his head in his hands for a few minutes and then tried to resume play. About an hour later he fell to the ground unconscious. He was unconscious

it has been demonstrated by McCallum<sup>29</sup> and other pathologists that one of the primary lesions of influenza toxin is an endothelolytic production of multiple hemorrhages. We have shown<sup>11</sup> that this occurs in the brain as well as elsewhere, and may produce symptoms. Now the question arises as to whether these cases reported may not be those so produced, and if so whether or not they are to be regarded as essential idiopathic epilepsy. Of course, the question perhaps hinges altogether on the meaning and delimitation of the word epilepsy.

The opinions of Dr. E. E. Southard, Dr. Adolph Meyer, Dr. S. E. Jelliffe, Dr. Wm. S. Shanahan and Dr. L. Pierce Clark were solicited as representative of the schools of thought concerning epilepsy in this country. The lamented Southard had given me his idea orally and was to have put it in writing the week of his untimely death. That he probably would have taken the view of an organic causation, *i. e.*, "epileptogenic foci and perhaps tissues favorable to epileptic discharge,"<sup>24</sup> for most syndromes which we call epilepsy, whether produced by an influenzal encephalitis, a syphilitic encephalitis or an idiopathic encephalitis, is apparent from such studies as those done in association with Lucas in 1912,<sup>30</sup> and alone in 1908.<sup>24</sup> The opinions of the other men follow:

Dr. Jelliffe writes:\*

"That influenza can produce not only somatic interruption of energy distributing pathways by exudative phenomena or abscess formation, or other typical encephalitic process, is obvious. That such interruptions can result in the epileptic discharge is also obvious and well documented. My own experience has scores of cases and the literature is abundant.

"Furthermore, that reduction in resistance, general functional lowering of distribution capacity, *a la Janet's* 'Niveau Mentale,' can permit the specific reactions called epilepsies to come through is also to me obvious, without any microscopic cellular alterations. Microscopic or chemical alterations with energy carrying capacity reduction lie behind these. These are, I think, equally obvious.

"The whole body as a distributing organism—effectors in their totality—can be seriously hampered by the interference in the coördinating pathways. I see no reason why we should not call them epilepsies if we are fairly definite as to what we can agree upon as to what is subsumed under the symbol. My own notion regarding the nosology is purely pragmatic and I am rather a little dubious as to the prevailing absolutistic nosologic entities."

for twenty-four hours and at that time an exploratory craniotomy was decided upon. The brain was exposed and no single large bleeding discharge was found as expected, but the entire surface of the brain exposed was studded with minute focal hemorrhages. The skull and scalp were closed and the lad made an uneventful recovery, but thereafter suffered from typical attacks of epilepsy. The skull was reopened by other surgeons repeatedly in attempts to remove some point of irritation but without avail.

\* From a letter of January 15, 1920.

Dr. Adolph Meyer writes (June 16, 1920):

"I can give you my general conception of the relation of epilepsy and infectious diseases. A large number of infectious febrile disorders and toxic disorders tend to lead to deliria and to convulsions. I am in the habit of connecting deliria with conditions which show also through the presence of edema of the membranes and perhaps also of the brain itself. This same condition is observed in epilepsy. To what extent miliary hemorrhages play a specific role in the production of epilepsy I would not be able to say. I do not, however, consider them essential and specific. In the main I would say it is probable that any cortical damage, either by poison or other injury including arteriosclerosis and circulatory disorders, can be the potential foundation for epileptic attacks.

"I may say that I am very much surprised to see so few of the encephalitis cases of the present epidemic with epileptic attacks. For the role of influenza it might be of value to inquire whether the cases that later developed epilepsy showed any special tendency to delirium or any cerebral involvement during the attack."

Dr. Clark writes:

"As regards the epileptic sequelæ of influenza, I am quite well aware of the fact that the Spanish influenza did aggravate in many instances epilepsies previously existing and in some instances seemed to have renewed attacks in those previously in a state of epileptic arrest.

"I think your criticism was quite true, that the boy was probably predisposed to epilepsy in his backwardness of mental development and probably possessed an irritable and sensitive nervous system upon which the influenza seemed to have acted as a precipitating factor for the attacks. In view of these facts one must say that, probably the case is not one of essential epilepsy but rather epileptiform and symptomatic in character and probably the prognosis will be very sound in such a case. But this, I think, only goes to prove that the influenza was really an initiator of the disorder and that it would probably not have been in evidence had it not been for the influenza.

"Singularity enough, Dr. Jelliffe thought also that my article concerned itself with influenza in general, and he believes that the present epidemic is not so dissimilar from ordinary influenza, to which I take great exception, after having seen a good deal of it both in clinics and in my own home. The bibliographic references that you gave to the old forms of influenza are quite pertinent to the disorder as we formerly knew it."

Dr. Shanahan writes (abridged from letter of January, 1920):

"I believe that after influenza, or any other severe infection which, during its course, attacks the central nervous system and damages the organic structure so that permanent change results, one may expect not only a mental deterioration but also some of the phe-

nomena ordinarily called epileptic. Again, of course, there may be but temporary disturbance of function of the brain or other organs of the body having control directly or indirectly of brain functioning, *i. e.*, endocrine glands, etc., and, as a result, epileptiform seizures.

"The degree of keenness of observation, the individual equation, the differing viewpoints, the varying severity of the influenza, the different sections of the country or world, the different years or epidemics, must all be considered. In the earlier epidemics classed as influenzal in nature how many looked for symptoms epileptiform in character?

"Personally I feel, as do many others, that the cause of influenza, be it bacterial or something else, makes itself apparent every winter or at least practically so, varying in intensity.

"In the winter of 1915-1916 we had at the colony a considerable number of cases of what was then called influenza. Several adults had marked delirium, twitching, etc. In some young patients, some not epileptic, there was apparently an encephalitis from the symptoms presented. A boy of four years, who was very fair mentally, developed in January, 1916, a severe illness which after a short time resulted fatally. He had had during practically a year preceding no seizures. With the onset of the illness referred to he had a series of severe convulsions with pulmonary edema, following which he continued in a stupor, practically a coma, occasionally crying out. A right hemiplegia developed. Until death, he had frequently convulsive movements confined to part of the right side and then again on the left side, but no further general convulsions. Lumbar punctures gave a clear fluid with no increase in cell count. He presented a double Babinski and exaggerated reflexes on the right side, pupils reacted normally to light, both fundi congested, right disk slightly blurred. Increased pressure observed when lumbar puncture was made on the seventh day of illness. On the ninth day of illness paralysis of the right side was less marked. No evidence of pneumonia. Babinski still present on both sides. Pupils react to light; no strabismus, but a lateral nystagmus was observed at times. On the eleventh day the patient died, apparently of a terminal pulmonary edema. Diagnosis was *encephalitis following influenzal infection*. Autopsy showed tremendous edema of the brain, so that the surface was misshapen, the convolutions being crowded together so that the sulci were only represented by lines. There was recent hemorrhage on the right side of the cerebellum. Unfortunately a microscopic examination of the brain could not be made.

"In November, 1918, during the influenza epidemic, Harry L. R., aged thirty-one years, who had long been a patient at the colony and was subject to frequent periods of mental excitement, developed a severe influenza, with jaundice and high temperature, dying on the eleventh day. Autopsy performed an hour and a half

after death showed the meninges considerably thickened and very cloudy and of the extreme yellow color. There was some hydrops of the subarachnoid space. The yellow discoloration did not extend into the brain substance. The brain itself was firm without gross lesion. Apparently the edema was not as marked as in the other case cited.

"I mention these two cases as a proof of similar infection during two periods and as evidence that extensive involvement of the brain and its membranes occur, and as a result such permanent structural damage takes place as to bring about disturbance of function, so that it would be very possible for the symptoms of an epilepsy to appear, even in an individual not epileptic."

#### IV. "THE INFLUENCE OF EPILEPSY UPON INFLUENZA."

This phrase is of French extraction, being taken bodily from the title of Maillard and Brune's article cited above.<sup>10</sup> Their observation that epileptics were unusually susceptible to influenza was supported by experience in this country. Without entering into the subject in detail we may cite as representative testimony the report of the manager of the State Epileptic Village at Skillman, New Jersey.

"When the first case of influenza occurred the population of the village was 900. There was 422 cases of influenza, with 67 deaths. . . . More than 46 per cent. of the entire population contracted the disease, the case incidence being substantially higher among the epileptic patients than among the employees; 48.9 per cent. in the former against 34.8 per cent. in the latter."

**Summary.** It appears, then, that insufficient attention has been paid to the influence of influenza, or, for that matter, of any of the acute infections, upon idiopathic epilepsy. Little reference to it can be found in the literature. Such fragmentary treatment as the subject receives here and there is inconclusive. The beneficial effect of acute infections, at least in so far as they inhibit epileptic attacks during the febrile period, is insisted upon by probably the majority of those considering the matter at all. One writer inclines toward a sort of specific differentiation, concluding that this infection increases, this one decreases epileptic manifestations. A few writers are convinced that infections benefit epilepsy permanently, and one even suggests exposure to pneumonia as a possible cure for a preëxistent epilepsy. But nearly all of these writers are strangely silent about the most ubiquitous of all modern epidemic infections, influenza.

For this optimistic impression of the effect of influenza upon epilepsy we find some little support from the recent pandemic. Questionnaires addressed to the superintendents of state hospitals

for epileptics were graciously answered. From these, and from data accumulated at the Boston Psychopathic Hospital and a few other sources, evidence of inhibition of attacks during the febrile period, and of decrease in frequency and perhaps severity of attacks following influenza, was secured. Illustrative figures and cases are cited.

On the contrary, however, we also have evidence, secured from the same sources, that the effect of influenza upon epilepsy may be and probably more often is aggravation. This, it appears, may be demonstrated by a simple increase in the frequency, if not in the severity, of the attacks; it may occur as an alteration in the form of the epileptic attacks; or it may appear in the production of a complicating psychosis. All of these unhappy equations are illustrated above by cases. Statistics would indicate that these deleterious effects of influenza were distinctly more frequent than the beneficial effects.

Nor is the obverse side of the picture yet complete. It appears that an epilepsy, previously manifested but long latent, may be fanned into flame again by influenza, and finally that epilepsy may perhaps be primarily caused by influenza in previously healthy persons. Numerous cases of epileptiform seizures occurring for a while after influenza, but usually ceasing, never to recur, have been reported in past epidemics. From the recent epidemic 3 cases are presented. Various opinions are held as to the significance of this phenomenon.

Of the four actions of influenza upon mental disease, which previous studies have led us to conclude are the usual ones, namely, creation, precipitation, aggravation and amelioration, all are represented in the case of epilepsy. As to "creation" some might quibble, but I believe we are pragmatically justified in assuming that the cases reported by Leichtenstern, Landgraf, Ruhemann, Van Deventer, Jaccoud, Clark, Shanahan and others really represent "epilepsy" produced by influenza, albeit epilepsy with a good prognosis, and, of course, not "idiopathic" epilepsy. We are scarcely justified in rejecting what is apparently typical epilepsy merely because the adjective "idiopathic" is no longer strictly applicable or the termination the conventional one. Presumably they are the product of influenzal neurotoxins and a susceptible brain. The fact that they are apparently reversible in reaction may as well be imputed to a peculiarity in the combination; presumably it is dependent on the type of effector (neurotoxin) rather than the type of receptor (neuron). Reversible reactions are not unfamiliar in the case of other diseases usually regarded as permanent, *e. g.*, Schizophrenia.<sup>22</sup>

Finally, the effect of epilepsy on influenza is the production of a generally lowered resistance, and hence abnormally high morbidity and mortality rates as compared with normal patients.

**Conclusions.** From a study of pertinent literature and of clinical material afforded by the epidemic of influenza of 1918-1919 the interrelations of influenza and epilepsy may be summarized, in conclusion, as follows:

1. The effect of influenza upon idiopathic epilepsy is not uniform.
2. Beneficial influence is occasionally observed; seizures are perhaps usually absent during the febrile state and in some instances occur with decreased frequency after the acute infection. There are no cases on record in which influenza has induced an entire cessation of epileptic attacks once instituted.
3. Deleterious influence is more frequently observed. This is manifested in various ways.
4. Seizures may occur with increased frequency following influenza, both as compared with short periods and long periods of time prior to the acute infection.
5. The character or type of the seizures may change subsequent to the influenza, in addition to or independent of the increase in frequency.
6. Epilepsies whose manifestations have long lain latent may be incited to renewed activity by the attack of influenza.
7. Psychoses may be precipitated in epileptics by influenza, as in non-epileptics.
8. Epileptiform syndromes which resemble typical idiopathic epilepsy, except that recovery usually occurs shortly, are occasionally evoked by influenza. Probably we should regard these as recoverable or "reversible" types of idiopathic epilepsy, the product of influenza and a (possibly) susceptible brain. Possibly they are manifestations of multiple miliary (encephalitic) hemorrhages.
9. But the majority of epileptic patients who had influenza did not exhibit any alteration in their disease.
10. The effect of "epilepsy on influenza" was observed to be a lowered resistance, and hence increased morbidity and mortality rates (as compared with normal persons).
11. Influenza thus appears to exhibit, in the case of epilepsy, the properties previously demonstrated to be operative in the case of the psychoses associated with influenza: creation, precipitation, aggravation and amelioration.

#### BIBLIOGRAPHY.

1. Gowers, William R.: *Epilepsy*, London, 1901.
2. Menninger, Karl A.: *Psychoses Associated with Influenza: I. A Statistical Analysis*, Jour. Am. Med. Assn., January 25, 1919, lxxii, 235.  
Meninger, Karl A.: *Influenza and Neurosyphilis*, Arch. Int. Med., July-15, 1919, xxiv, 98.
3. Quoted from Friedlaender: "Ueber den Einfluss des Typhus Abdominalis auf das Nervensystem," 1901, by Hamilton, Arthur S., *The Effect of Intercurrent Disorders on Pre-existent Epilepsy*; Jour. Am. Med. Assn., December 4, 1909.
4. Delasiauve: *Traité de l'épilepsie*, 1854: Lannois, 1893.
5. Veyssset, Louis Leon: *De l'influence des maladies infectieuses sur la développement de l'épilepsie*: Paris, Ollier Heny, 1889, 476.

6. Seglas, Jules: De l'influence des maladies intercurrents sur la marche de l'épilepsie: Paris, Bureau d. Prog. Medi., 1881, ii, 1.
7. Turnowsky, M.: Drei Fälle von Vollständig Geheilter Epilepsie: Wiener Med. Wchnschr., 1901, No. 35, p. 1022.
8. Oppenheim, H.: Text-book of Nervous Diseases: Edinburgh, 1911, translation by Bruce.
9. Paton, Stewart: Psychiatry; Philadelphia, 1905.
10. Maillard, M. G. and Brune (Mme. le Dr.): Grippe et épilepsie: La presse médicale, February 10, 1919.
11. Menninger, Karl A.: Psychoses Associated with Influenza: II. Specific Data, An Expository Analysis, Arch. Neur. and Psych. 11, September, 1919, 291-337.
12. Clark, L. P.: Influenza and Epileptiform Attacks, Jour. Am. Med. Assn., December 6, 1919, No. 23, lxxiii, 1767.
13. Leichtenstern, O.: In Nothnagel's Encyclopedia, volume on Malaria, Influenza and Dengue. English translation by Stengel, Philadelphia, 1905 (Saunders).
14. Rulemann, J.: Die Influenza im Winter, 1889-1890; Leipsic, 1891, a monograph of 188 pages, dealing with influenza in a general way.
15. Landgraf: Gesellschaft der Charité-Aerzte in Berlin: Berl. klin. Wchnschr., 1890, Nos. 9 and 12.
16. Van Deventer: Centralbl. f. Nerven- u. Psychiatr., xiii, 49.
17. Jaccoud: Pathologie interne, Paris, 1870, p. 780.
18. Jaccoud: Nouveau dictionnaire, etc., Paris, 1873, Part 16, p. 740.
19. Voisin, J.: L'Épilepsie, Paris, 1897.
20. Gelineau, J. B.: Traité des épilepsies, Paris, 1901, "Épilepsie grippale."
21. Biet: Des Affections Nerveuses Consécutives à la Grippe, Paris, 1895.
22. Menninger, Karl A.: Influenza Psychoses in Successive Epidemics, Archives of Neurology and Psychiatry, January, 1920, No. 1, iii, 57.
23. Damaye, Henri: Progrès méd., December 13, 1919, xxxiv, Sol.
24. Southard, E. E.: On the Mechanism of Gliosis in Acquired Epilepsy, Am. Jour. Isan., 1907-8, lxiv, 607-641.
25. Paulian, M.: Les complications nerveuses du typhus exanthématique; La presse médicale, September 25, 1919, No. 54; Manifestations nerveuses du typhus exanthématique; Revue neurologique, August, 1919, No. 8; Les complications nerveuses du typhus exanthématique: Bucharest, 1919. (Dr. Paulian's introductory sentence stimulates both interest and confidence. "J'ai écrit ce que j'ai vu.")
27. Skoog, A. L.: Measles, Brain Complications, Jour. Am. Med. Assn., 1920, 74, 1697.
28. Raeder, Oscar J.: Endocrine Imbalance in the Feeble-minded, Jour. Am. Med. Assn., 1920, 75, 527.
29. McCallum, W. G.: Pathology of Pneumonia following Influenza, Jour. Am. Med. Assn., March 8, 1919, No. 720, lxxii, also paper read at Congress of Physicians and Surgeons, Atlantic City, June, 1919.
30. Lucas, W. P. and Southard, E. E.: Encephalitis and Epilepsy, Boston Med. and Surg. Jour., February 29, 1912; Further Observations upon Nervous and Mental Sequelæ of Encephalitis in Children, Boston Med. and Surg. Jour., September 4, 1913.
31. Menninger, Karl A.: Communication to the Editor, Jour. Am. Med. Assn., December 20, 1919.
35. Menninger, Karl A.: Influenza and Hypophrenia, Jour. Am. Med. Assn., October 16, 1920, No. 16, 75, 1044-1051.